



**EFFECTS OF SHIFTWORK ON
AIR FORCE AIRCRAFT MAINTENANCE PERSONNEL**

THESIS

Craig A. Campbell, First Lieutenant, USAF

AFIT/GTM/LAL/98S-2

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**DEPARTMENT OF THE AIR FORCE
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Acquisition Management of the Air Force Institute of Technology**

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Air Education and Training Command

**In Partial Fulfillment of the Requirements for the
Degree of Master of Science in Transportation Management**

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Abstract

This study examined the effects of converting a large aircraft maintenance squadron from 8-hour shifts to 12-hour shifts. The squadron studied converted its 24-hour maintenance work force from three 8-hour work shifts to two 12-hour work shifts incrementally, with one section converting to 12-hour shifts in January, 1996, and the remaining section converting in July, 1996. Both sections remained on 12-hour shifts until September, 1997, when both sections converted back to a three shift 8-hour operation. Health and well being, on- and off-duty accident rates, day shift vs. night shift accident rates, and the effects of stress and fatigue on specific satisfactions, job dissatisfaction, and reenlistment intentions were examined. Results showed an increase in hospital visits when 12-hour shifts were employed, as well as an increase in hospital visits immediately following all schedule changes. There were no significant differences in 8-hour and 12-hour shifts on- and off-duty accident rates or day and night shift accident rates. Reported levels of fatigue were significantly greater when 12-hour shifts were used. Tension was greater while on 12-hour shifts, but did not decrease significantly until a few months after the conversion back to 8-hour shifts.

EFFECTS OF SHIFTWORK ON AIR FORCE AIRCRAFT MAINTENANCE PERSONNEL

I. Introduction

Issue

In order to effectively manage Air Force personnel, and retain them even in times of stress and change, it is important to understand what influences their decision to reenlist in the Air Force and what factors affect their satisfaction with the job. Air Force manning levels have decreased over the past several years. At the same time, the service has faced an increase in operations tempo and deployments all over the world. These factors have made it important for commanders to find ways to complete the mission even though manning levels have decreased. One such method is to increase the number of hours worked by available personnel. The use of extended work-shifts is common in the military during times of contingency and times of excessive workload. The effects of extending work-shifts on individual workers are very important for us to understand. Previous research supports the belief that extended work-shifts directly impact workers health, attitudes, and performance. Researchers have also been concerned about the effects of changing between work-shift schedules. A thorough understanding of the effects of extended workdays on personnel, as well as an understanding of the effects of shift changes themselves will assist commanders, supervisors, and workers alike in effectively and efficiently completing the mission. It is also important to understand how workers health and well being are affected by changes in work-shifts and the use of

extended shifts. Another area of concern for managers is the effect of extended work hours on accidents, both on- and off-duty.

Recently, a large aircraft generation squadron located on the Eastern seaboard converted much of the maintenance work force from a five-day, 8-hour work day to a 2-3-3-2 schedule (2 days work, 3 days off, 3 days work, 2 days off) with 12-hour shifts. This was done incrementally, with one section converting to the 12-hour shift schedule in January, 1996, and the other section converting to the same schedule in July, 1996. Both sections remained on the 12-hour work schedule until September, 1997, at which time both shifts converted back to a five-day, 8-hour work schedule. Overland (1997) examined the effects of 12-hour shifts on workers health and well being, attitudes, and situational constraints affecting their performance. The present study continues and extends Overland's study. It focuses on the effects of change on the personnel and examines the factors that influence decisions to reenlist in the Air Force during normal schedules and during extended workdays. It also investigates the effects that the transition or change has on the individual's attitudes, to include stress and fatigue, workers health, and accidents.

Purpose

This research investigated the relationship between worker attitudes, health, and safety during times of normal work hours, extended work hours, and during the adjustment period following a change in work-shifts. It is intended to give commanders and supervisors a better understanding of the effects of extended work days so they can better prepare their personnel and understand the factors which influence their decision to continue serving in the Air Force.

II. Literature Review

The Bureau of the Census for the Bureau of Labor Statistics recently estimated that approximately one in five Americans is a shift worker (Duchon & Smith, 1993:37). Shift workers include workers who work night shifts, rotate from one shift to another, or work schedules different than a typical 8-hour day. In recent years, the number of personnel who work shifts has increased substantially, and although shift work has been rationalized on a technical and economic basis, there are still concerns about the effects of these shifts on workers (Laundry & Lees, 1987:163). The rising trend in shift work can also be attributed to the advances in technology and the need to operate expensive equipment around-the-clock. In many instances, employees who value having large blocks of time away from the job have endorsed the use of 12-hour shift systems. Depending on the shift system used, employees can have as much as 4 or 5 days between shifts (Lees & Laundry, 1989:81).

The military is unique in its' operation. Many of the work centers that support the Air Force flying mission must maintain 24-hour coverage, 7 days a week. In addition, when units deploy with minimum personnel the use of extended workdays may be necessary to ensure mission readiness. The process of changing from normal 8-hour shifts to extended workdays can affect factors such as safety, health, and worker attitudes.

Many studies have been conducted to examine the effects of extended shifts. The overall conclusion of these studies is that the use of extended shifts can cause problems for both the organization and the individual. Effects fall into two major categories: the effects on the organization (efficiency, productivity, safety, absenteeism) and the effects

on the individual (social issues, health and well being, and general attitudes towards the job) (Alluisi & Morgan, 1982:176). Duchon and Smith (1993) reported that several studies showed workers in various industrial groups who worked extended shifts displayed poor performance, increased accidents, increased health problems, low morale, and high job dissatisfaction.

The military has mainly been concerned with the effects of extended workdays on the performance of pilots and soldiers (Palmer et al., 1996). However, technological advances in weapons systems and increased emphasis placed upon the maintenance of these complex systems suggest the need to also consider the effects of extended workdays on the performance of maintenance personnel.

Many studies investigated the links between shift work and increased accidents. Unfortunately, according to a review of several of these studies (Duchon & Smith, 1993) inconsistencies among the studies, such as combining accident data on and off the job, make it difficult to interpret their results. Nonetheless, Duchon and Smith (1993) reached several conclusions concerning extended workdays and safety. They reported that, regardless of the situation, workers tend to embrace the use of extended workdays and compressed work schedules because of the extended breaks between work periods that exist. They also found performance and/or safety decrements were associated with the use of longer workdays. Finally, they recommended that more research on extended workdays be accomplished, especially for firms where safety is of major importance.

Research on accidents related to 12-hour shifts has produced mixed results. Northrup et al. (1989) interviewed management representatives of fifty plants in U.S. and Canadian chemical and petroleum industries. In every case, the change from 8-hour to

12-hour shifts improved morale of the workforce without impairing efficiency, safety, or worker well being. However, the industries studied had highly automated systems that didn't require extensive physical exertion. The management representatives interviewed suggested that industries with more arduous work should be cautious about implementing 12-hour shifts (Northrup et al., 1989). Other research has shown that long workdays are highly correlated with accidents or injury (Duchon & Smith, 1993). Levin et al. (1985) studied two paint plants over ten years and found a significant increase in accidents during the night shift, particularly during the last 3 hours of the shift. Kelly and Schneider (1982) performed a study to examine the impact of 12-hour shifts at locations which have large amounts of hazardous materials, such as nuclear power generating plants and heavy water production facilities, on public safety. The study concluded a doubling of human error when 12-hour shifts were employed. Klein (1988) reported that a disadvantage of 12-hour shifts is the higher risk of accidents and mistakes.

In a study of accident rates over two 10-year periods at a large manufacturing plant, Lees and Laundry (1989) analyzed data before and after the change from 8-hour to 12-hour shifts. They used data from 1965 to 1975 while the workforce was on a traditional 8-hour shift schedule and data from 1975 to 1985 after the plant changed to a 12-hour shift schedule. Although overall accidents were apparently lower on the 12-hour shifts, statistical significance was reached only for minor accidents. At the same time, off-the-job injury rates rose, possibly due to the increased time off afforded the workers by the 12-hour shift schedule. No relationship existed between age, experience, and accidents. Because increased fatigue is related to extended workdays, Lees and Laundry (1989) expected to find an increase of on the job accidents at the manufacturing plant.

The opposite occurred. There was a trend of lower accident rates with longer shifts. However, the authors did observe a significant increase in the accident rates immediately following the conversion to longer shifts, followed by a decline to levels lower than previously recorded on the 8-hour shifts. This immediate increase in accident rates in conjunction with the change to 12-hour shifts is consistent with the previous study conducted in the aircraft maintenance squadron (Overland 1997). A peak immediately following the conversion of one section was noted, followed by a rising trend when the remaining section converted to 12-hour shifts.

Overland (1997) focused on traffic accidents and industrial (on-the-job) accidents, and used the aggregates. For the present study, new data were obtained that make it possible to compare off-duty and on-duty accident rates, as well as night shift vs. day shift accident rates for reportable accidents. Based on the literature review and the results of the previous study conducted at this aircraft generation squadron, it's expected that the off-duty accident rate will rise when 12-hour shifts are introduced (due to increased leisure time) and the on-the-job accident rates should remain the same. One reason an increase in on-duty accidents is not expected during 12-hour shifts is that supervisors conducted comprehensive safety briefings at each shift change and squadron leadership was very involved in promoting both on- and off-duty safety. Another expectation is that a significant difference between the day shift and night shift accident rates will exist not only on the 12-hour shifts, but on the 8-hour shifts as well, with the number of accidents being greater on the night shift. Budnick et al. (1994) concluded that night shift workers have an increased risk of vehicular and performance errors, as well as mishaps. Nighttime workers, regardless of shift, may have "diminished alertness and performance,

with attendant increases in the number of fatigue-related accidents during the nighttime hours” (Czeisler et al., 1990).

Health and well being of the workers is another area of concern when analyzing the use of 8- and 12-hour shifts. Several studies have been conducted on the health and well being of shift workers. Budnick et al. (1994) report that shift workers have an increased risk of adverse health effects, especially gastrointestinal disorders, and possibly cardiovascular disease, and may have increased health care costs compared to traditional day shift workers. In a study of 12-hour operations in a petrochemical plant, it was reported that health and well being of employees stayed the same as on the 8-hour shift, or improved in some instances (Duchon & Smith, 1993). It should be noted that the data were gathered using self-report instruments, and the majority of employees favored the extended shifts.

Sparks and Cooper (1997) performed a meta-analytic review of the effects of hours of work on health. They found that longer hours of work were associated with stress and fatigue, which can overtake an individual both mentally and physically. They reported that long working hours have been associated with poor lifestyle habits such as heavy smoking, inadequate diet, and lack of exercise which, themselves can lead to health problems. In their review they state that studies of overtime have identified fatigue as an important factor in the hours of work and health relationship. The results of the meta-analysis show that increased work hours were associated with increased health symptoms (Sparks & Cooper, 1997). These results seem to support the notion that working long hours can be detrimental to workers health. Problems with workers health can also contribute to increased absenteeism. Workers on extended shifts are reported to use more

sick leave and regular vacation time (Williamson et al., 1994). A review of literature on compressed workweeks revealed persistent concerns about feelings of increased fatigue associated with long workdays (Rosa et al., 1988). Lees and Laundry (1989) found that fatigue and stress were often associated with health-related symptoms such as headaches, gastric upset, alcohol problems, and diarrhea. It is also important to emphasize that a person's physical fitness can predict how well a person adapts to shift work (Ferrer et al., 1995:573). Ferrer et al. (1995) found that individuals who are physically fit (exercise regularly) have higher circadian rhythm amplitudes than unfit individuals, and those with high circadian rhythm amplitudes are more tolerant to shift work. Gordon et al. (1986) described the circadian rhythm as follows:

It is well documented that certain physiologic functions, e.g., body temperature and hormonal release, vary systematically over the course of the day. These physiologic functions are regulated by the body's internal clock which has a longer than 24-hour intrinsic period and which is synchronized to the 24-hour day by cues from the external environment (zeitgebers), e.g., light and temperature. These circadian rhythms play important roles in regulating sleep, alertness, and other physiologic processes. When workers are forced to alter their sleep/activity schedule abruptly to correspond to a new work shift, there is usually a mismatch between the body's resources and the demands placed upon it until the circadian phase can adjust.

Individuals differ in their adaptation to shiftwork and a change in shifts (Folkard & Monk, 1979: 489). It has been reported that some people never adjust to disruptions caused by shiftwork (Taylor et al., 1997:68). Internal dissociation, or desynchronization, occurs when circadian rhythms are no longer synchronized with the external environment or new work/rest cycles (Crew Systems Directorate, 1996). Internal dissociation might also happen when shift workers change shifts. "Similar to jet lag, the clinical expression of this is referred to as shift lag" (Crew Systems Directorate, 1996). Luna (Crew Systems Directorate, 1996) further explains that a change in shift, or shift rotation, is similar to

crossing time zones. Increased stress and fatigue have also been associated with disruptions in the circadian rhythm (Levin et al., 1985). It has been established that the degree and quality of social interaction is related to health (Gordon et al., 1986). This would suggest that the level of social support needed from coworkers, supervisors, and family would increase during times of disruption and increased stress.

The workers ability to choose which shift they work can have an impact on the health problems they experience while working extended days (Barton et al., 1993). When workers can choose their shift, health problems are likely to be far less compared to individuals who have no control over their work schedule. Overland (1997) found an increased level of fatigue in aircraft maintenance personnel on 12-hour shifts compared to personnel on 8-hour shifts. He also reported that the first sections conversion to 12-hour shifts resulted in an increase in hospital visits greater than the increase over the same period of time for 8-hour workers. However, when the second section converted to 12-hour shifts, the increases in hospital visits were not significantly different than that sections pre- and post- treatment hospital visits. Overland (1997) suggested that a learning effect might have been present. Nevertheless, he noted that peaks in health problems occurred immediately following the implementation of extended shifts. The change itself appears to increase desynchronosis (internal dissociation), stress, and fatigue that lead to health problems. These outcomes usually decrease over time, as the individuals adjust to different schedules and overcome the shift lag. Therefore, it is expected that fatigue and stress will return to lower levels on 8-hour shifts; however, based on the disruptions in the circadian rhythms caused by the change of schedule, an increase in stress and fatigue should occur initially after the change, and eventually drop

below the levels experienced during the prolonged use of 12-hour shifts. Hospital visits, an indicator of health problems associated with shift work, should be significantly higher during the time when 12-hour shifts were employed and should decrease as the individuals adjust to the 8-hour schedule.

Just as stress affects health and accidents, it is also expected to affect job-related attitudes. An important individual outcome is job satisfaction. Cunningham (1989) found that extended shifts and compressed workweeks may improve job satisfaction, morale, and the individual's satisfaction with their marriage and the use of leisure time. He also found, in his study of coal miners in Western Canada, that the use of 12-hour shifts did not improve the large turnover for the company. Turnover, or intent to leave company, is affected by an individual's satisfaction with the job (Kossek & Ozeki, 1998). The understanding of what influences an individual's decision to continue serving in the Air Force could potentially aid managers in retaining highly trained personnel. This study examines the relationship between specific satisfactions, job dissatisfaction, and reenlistment intentions.

In a study using meta-analytic procedures, Hellman (1997) found that the relationship between job satisfaction and intent to leave was significantly different from zero and consistently negative. Fishbein and Ajzen (1975) argued that "behavioral intention is the primary antecedent to the actual behavior." A review of studies also indicated that intent to leave an organization is an important predictor of actual turnover (Hellman, 1997). Thus, individual intent to leave should lead to the actual behavior of leaving, and intent to reenlist should lead to actual reenlistment.

Ajzen and Fishbein (1980) discuss the factors that determine a person's behavior. There are certain stimuli, such as 12-hour shifts or a change in the work schedule, which lead to an attitude. These attitudes result in intentions, which lead to the actual behavior. Attitude formation depends on present or past perceptions of the attitudinal object for the individual (Wagner & Sherwood, 1969:20). Individuals draw from past experiences and form attitudes. Confusion and stress can occur when individuals have no experiences with which to compare their situation, and, it is difficult to predict what behavior they will exhibit. The relationship in the actual behavior is as follows: Stimulus > Attitude > Intention > Behavior. It is expected that an increase in fatigue and stress during 12-hour shifts will increase job dissatisfaction and lead to a decrease in reenlist intentions, a predictor of actual reenlistment. A decrease in fatigue should occur eventually, after the initial increase in fatigue and tension immediately following the conversion back to 8-hour shifts. This eventual decrease in fatigue and tension should lead to a decrease in job dissatisfaction and, subsequently, an increase in reenlistment intentions. It is unknown what to expect during the time of change or transition immediately following the conversion to 8-hour shifts. Fatigue and stress are expected to rise initially, but the relationship with reenlistment intentions and job dissatisfaction is unknown. Expectations are presented for 12-hour shifts and 8-hour shifts; however, during times of transition and change the individuals may not have past experiences with which to compare the situation. Therefore, no expectations are presented for the time when the conversion took place, other than the expected rise in fatigue and tension immediately following the change.

Several expected outcomes for this study have been identified in the preceding paragraphs. A summary of these expectations, based on the literature reviewed and the results of the previous study performed by Overland (1997), is provided below.

- 1) Off-duty accident rates will be higher during the period when 12-hour shifts were in use. There will be no difference in on-the-job accident rates between the periods when 8-hour shifts were in use and when 12-hour shifts were in use. There will be a significantly higher incident of accidents on night shift as opposed to day shift for all observed periods.
- 2) Hospital visits, an indicator of health problems, will be significantly higher during the time when 12-hour shifts were in use. Hospital visits are not expected to immediately decrease after the change to 8-hour shifts because of the effects of shift lag.
- 3) The increased stress and fatigue and increased job and shift dissatisfaction during extended shifts will lead to a lower intent to reenlist than on 8-hour shifts.
- 4) During 12-hour shifts and during the months following the change to 8-hour shifts (adjustment period) social support needed from coworkers, supervisors, and family members will be important to the individuals as a way to cope with stress.
- 5) Extended shifts and shiftwork will lead to increased stress and fatigue and increased job and shift dissatisfaction. An increase in stress and fatigue will occur immediately following the change to 8-hour shifts, but will return to levels lower than those experienced on 12-hour shifts after an adaptation period.

III. Method

Subjects and Procedures

Surveys were administered to a heavily tasked aircraft generation squadron on the Eastern seaboard composed of mainly enlisted maintenance personnel. As reported by Overland (1997), this squadron maintains all base-level aircraft, including both assigned and transient aircraft. The squadron is heavily tasked to support mobility operations world wide, and, on the average, has 10 percent of its personnel deployed at any given time.

Surveys were administered at three different times. Overland (1997) administered the first survey in January, 1997. The majority of the maintenance workforce was on 12-hour shifts at that time. The author administered the second survey in September, 1997, one week after the squadron converted back to 8-hour shifts. The third survey was administered in December, 1997, by the author, and through February, 1998, by the non-commissioned officer in charge of the quality office for the squadron surveyed. The third survey was identical to the second survey, and was administered between 3- and 5-months after the squadron returned to an 8-hour shift operation.

The completion of the survey was strictly voluntary and the entire squadron was asked to participate. The first survey had 411 respondents, of which 392 usable surveys resulted (Overland, 1997). The second survey had 99 respondents, 53 who took the initial survey. The third survey had 121 respondents, 73 who took the initial survey.

Measures

Two different surveys were developed to measure workers attitudes. The first survey was developed by Overland (1997) to measure a set of situational constraints, employee attitudes, and other outcomes of workers. The majority of the workforce was on 12-hour shifts when the survey was administered. The second survey was developed by the author to measure the same outcomes immediately following the squadron's conversion back to 8-hour shifts. The third survey, identical to the second, was administered between 3- and 5-months following the conversion back to 8-hour shifts. Survey one can be found in Appendix A. Surveys two and three (identical) can be found in Appendix B.

Survey 1

Specific Satisfaction. Thirteen questions from Hackman and Oldham (1975) were used to measure the individual satisfactions with *pay, job security, social aspects of the job, supervision, and growth potential*. The alpha coefficients were as follows: *pay* .82 (N=383), *security* .75 (N=383), *social aspects* .69 (N=383), *supervision* .86 (N=383), and *growth* .79 (N=383). Individuals responded on a 7- point scale ranging from *Strongly Disagree* (1) to *Strongly Agree* (7).

Fatigue and Stress. House and Rizzo's (1972) item scale was used to measure tension and pressure from job requirements and the outcomes in emotions or physical symptoms. The sub-scales for job-induced tension ($\alpha=.76$, N=380) and general fatigue and uneasiness ($\alpha=.65$, N=383) were used. Individuals responded *True* (2) or *False* (1).

A typical measurement of fatigue was *I seem to tire quickly*. An example of a measurement of tension was *I have felt fidgety or nervous as a result of my job*.

Reenlistment intentions. Two questions written by Overland (1997) measured the individual's reenlistment intention ($\alpha=.71$, $N=382$). Individuals responded on a 7-point scale ranging from *Strongly Disagree* (1) to *Strongly Agree* (7). The questions included the following: *I plan on continuing my career choice* and *I enjoy being in the Air Force and plan to reenlist*.

Surveys 2 and 3

Fatigue and Stress. House and Rizzo's (1972) item scale, identical to the scale used in survey 1, was used to measure general fatigue and uneasiness.

Reenlistment Intentions. Three questions from Cammann et al. (1979) were used to measure the individuals intent to leave the organization. Two of the items were reverse coded to obtain an intent to stay measure. The two items that were reverse coded were *I often think about separating from the Air Force* and *I will probably look for a different job within the next year*. The third question from the item scale was *I plan on continuing my career choice*. Additionally, two questions written by the author were used to measure the individuals intent to reenlist in the Air Force. These questions were *I enjoy being in the Air Force and plan to reenlist* and *I would reenlist today if I could*. The five items were averaged ($\alpha=.90$, $N=98$ survey2, $\alpha=.87$, $N=117$ survey 3) to measure reenlistment intentions. Individuals responded on a 7-point scale ranging from *Strongly Disagree* (1) to *Strongly Agree* (7).

Job Dissatisfaction. Four questions from Quinn and Staines (1979) item scale were used to measure overall job dissatisfaction. A typical question was *If you were free to go into any type of job you wanted, what would you choose?* Responses included *Take the same type of job I have now*, *Take a different type of job*, and *Not want to work*. The responses were totaled and a mean score was calculated for the four questions ($\alpha=.84$, $N=99$ survey 2, $\alpha=.86$, $N=120$ survey 3).

Leader/Member Exchange. Scandura and Graen's (1984) scale was used to "measure the quality of exchange between supervisors and subordinates." Seven questions were asked and the items summed for each member, resulting in a possible range of scores from 7-28 ($\alpha=.93$, $N=97$ survey 2, $\alpha=.85$, $N=121$ survey 3). A typical question from the scale was *How well do you feel your immediate supervisor understands your problems and needs?* The responses were *Completely* (4), *Well enough* (3), *Some but not enough* (2), and *Not at all* (1).

Social Support. A scale from Caplan et al. (1980) was employed to measure the social support received from *supervisors* ($\alpha=.89$, $N=99$ survey 2, $\alpha=.87$, $N=119$ survey 3), *coworkers* ($\alpha=.85$, $N=99$ survey 2, $\alpha=.79$, $N=120$ survey 3), and *family* ($\alpha=.87$, $N=99$ survey 2, $\alpha=.79$, $N=119$ survey 3). Four questions were asked in each of the three categories. A typical question was *How much can these people be relied on when things get tough at work? Your immediate supervisor; Other people at work; Your spouse, friends, or relatives.* Individuals responded to each category on a 4-point scale ranging from *Not at all* (1) to *Very much* (4). Respondents were also given a fifth response option of *Don't have such a person* (0).

Manning Levels. The unit deployment manager maintains unit manpower strengths. The manning levels were reported quarterly. A moving average of the quarterly levels was applied to estimate monthly manning levels. The averages were used in accident and hospital analysis to control for fluctuations in manning levels.

Hospital Visits. The number of sick-call visits for the entire squadron, by month, was obtained from hospital administration personnel. The number of sick-call visits was used as a measure of health and well being of squadron members. The total sick-call visits for each month were divided by the average manning for that month to get a monthly per person sick-call rate.

On-Duty and Off-Duty Accidents. Both on-duty and off-duty accident data are maintained by the squadron safety representative. On-duty accident data are also maintained at the wing safety office. Off-duty per person mishap rates were calculated using the data provided by the squadron safety representative. Total monthly off-duty accidents were divided by average manning for each month to get per person off-duty accident rates for each month. On-duty per person accident rates were calculated using the same method. The wing safety office on-duty accident data were used because the time of the accident was included in their report. A comparison of day shift vs. night shift accident rates was performed. In the day shift vs. night shift comparisons, manning levels for each shift were calculated using the percentage of total manning assigned to each shift, as reported by the squadron quality advisor. The accidents for each shift were divided by the manning levels for each shift to obtain a per person accident rate. For night shift calculations during 8-hour shift operations, both swing shift (1530 hours – 2330 hours) and midnight shift (2330 hours – 0630 hours) accidents were combined to

create a single night shift accident total. During 12-hour shift operations the day shift worked from 0700 - 1900 hours. The night shift worked from 1900 – 0700 hours.

Observation Periods

Three time periods were carefully chosen to compare the differences between pre- and post-treatment means for sick-call visits and on- and off-duty accident rates with the period when 12-hour shifts were used. Each time period was six months in length. The first time period was between October, 1994, and March, 1995. This period was chosen to represent health and safety incidences prior to any discussion of converting the maintenance workforce to 12-hour shifts. The second time period was October, 1996, through March, 1997. During this time period, the majority of the maintenance workforce was on 12-hour shifts. The third time period was October, 1997, through March, 1998. This is the six-month period after the conversion back to 8-hour shifts. The workforce changed back to 8-hour shift operations in September, 1997. Selection of the same months during different years was done to control for any effect of seasonality on health and accident rates. The means of the different time periods were compared using a *student's t-test*.

Analysis Approach

Data analysis consisted of the comparison of individual responses on each of the three surveys. The group means on individual outcomes and predictors were compared using Analysis of Variance (ANOVA) procedures. The measures that were the same in all three surveys were compared. These measures were fatigue, tension, and reenlistment

intentions. The mean number of per person hospital sick call visits for each of the three observation periods and the mean number of per person accident rates, on- and off-duty and day and night shift, for each of the three observation periods were compared using the *student's t-test*. Correlation tables were constructed to show relationships between individual variables and outcome variables for each of the surveys administered.

Correlations with p-values less than or equal to .05 were considered significant.

IV. Results and Analysis

This section contains results of accident data analysis, both on- and off-duty, and night vs. day shift. Results of health data analysis, as well as a discussion of results of the three surveys administered to the aircraft generation squadron personnel at three different times are also discussed. The results from the first survey, which will be referred to as S1, were taken from the survey administered by Overland (1997) in January, 1997. The majority of the maintenance workforce was on 12-hour shifts at that time. The results from the second survey, administered by the author immediately following the conversion back to 8-hour shifts in September, 1997, will be referred to as S2. The results of the third survey, administered by the author and the quality advisor between December, 1997, and February, 1998, after the workers were on 8-hour shifts for a period of 3 to 5 months, will be referred to as S3.

Figure 1 shows the off-duty accident rates (per person) for the entire squadron between September, 1994, and March, 1998. An increase in off-duty accidents was expected, due to the increased time off afforded by the compressed schedule. This increase would match the results of a study conducted over two 10-year periods at a large manufacturing plant, where the off-duty accident rate rose significantly when 12-hour shifts were used, because of the increase in time away from the job (Lees & Laundry, 1989). No significant difference existed between the mean per person accident rate for a 6-month period when both sections were on 12-hour shifts (October, 1996 – March, 1997) and a 6-month period following both shifts conversion back to 8-hour shifts (October, 1997 – March, 1998). To control for possible seasonality, the same months

(different years) were used in the comparison. It is also interesting to note that no significant difference in the mean per person off-duty accident rate existed for a 6-month period prior to the start of 12-hour shifts (October, 1994 – March, 1995), and either period discussed above. The absence of an increase in off-duty accidents could be attributed, at least partially, to the involvement of supervisors and safety office personnel. Comprehensive safety briefings and educational materials were conducted and distributed consistently throughout the squadron. Squadron leadership's involvement and concern about safety, both on- and off-duty, was apparent during both visits to the squadron by the author.

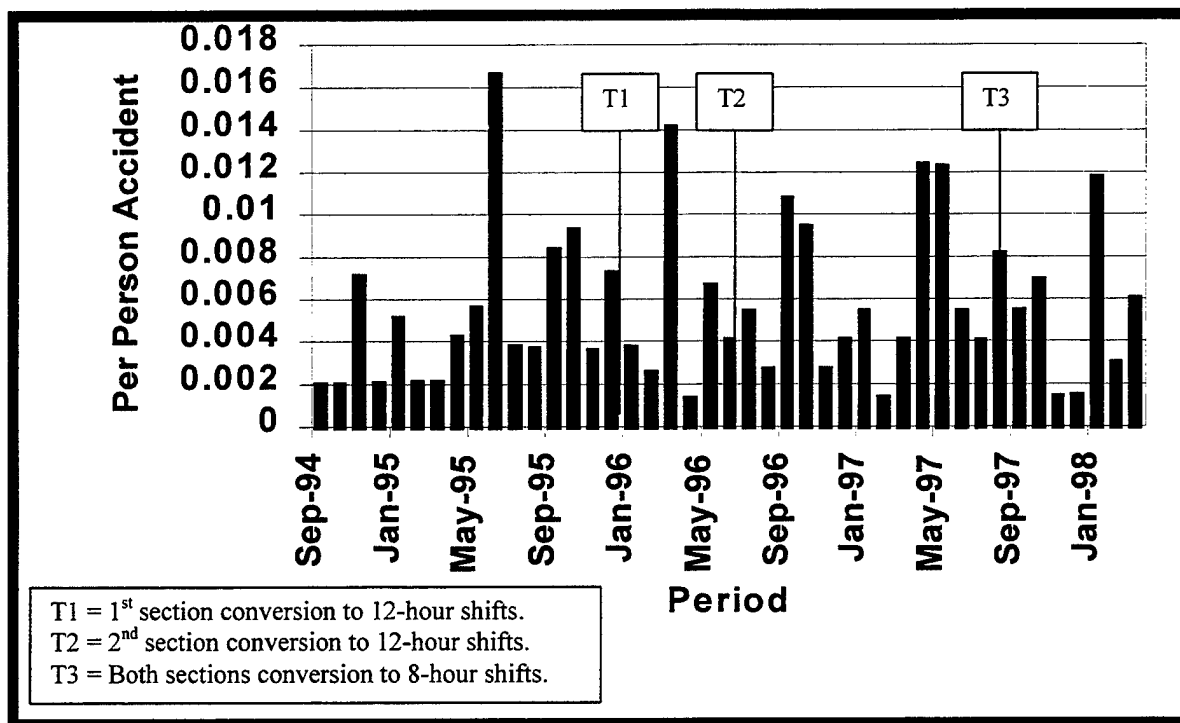


Figure 1. Off-Duty Per Person Accident Rates.

On-duty accident rates were not expected to rise during the period when 12-hour shifts were in use. In the same study mentioned above, no difference in the on-duty accident rates existed during the times when 8-hour shifts were used and the times when 12-hour shifts were used (Lees & Laundry, 1989). Northrup et al. (1979) also found no significant differences in safety incidences when 12-hour shifts were employed. Figure 2 shows the per person accident rates for the entire squadron from October, 1994, through March, 1998. Results of analysis showed no significant difference between a 6-month period well before either section converted to 12-hour shifts (October, 1994 – March, 1995), a 6-month period when both sections were on 12-hour shifts (October, 1996 – March, 1997), and the 6-month period after both sections converted back to 8-hour shifts (October, 1997 – March, 1998). The same months were used, as was done in off-duty accident analysis, to control for possible seasonality. It is interesting to note that a substantial increase in on-duty accidents occurred the month after the first sections conversion to 12-hour shifts, but no apparent increases occurred when the second section converted to 12-hour shifts or when both sections converted back to 8-hour shifts. Squadron leadership's involvement and concern most likely contributed to the consistently low number of on-duty accidents, even when 12-hour shifts were used.

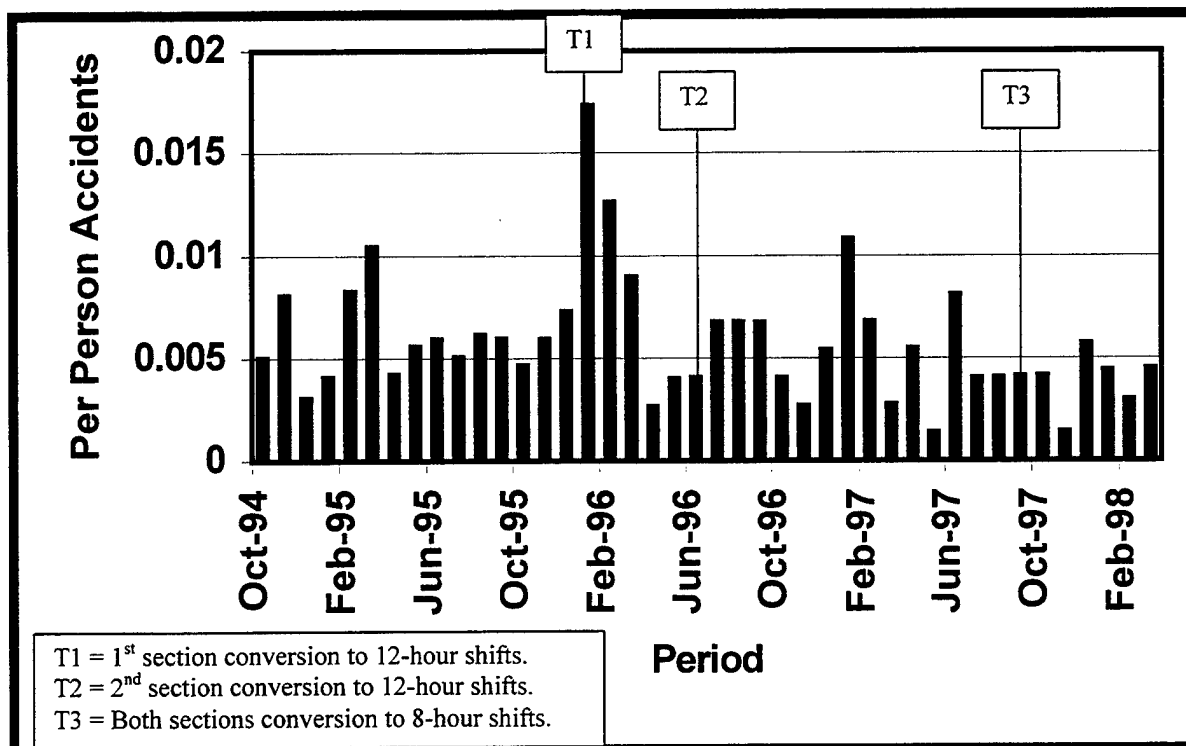


Figure 2. On-Duty Per Person Accident Rates.

Another hypothesis was that the difference between day shift and night shift accident rates would be significant in all time periods, with the number of accidents being greater on the night shift due to the increased risk associated with nighttime work. Budnick et al. (1994) concluded that night shift workers have an increased risk of mishaps. It has also been found that nighttime workers, regardless of shift, may have “diminished alertness and performance, with attendant increases in the number of fatigue-related accidents during the nighttime hours” (Czeisler et al., 1990). Figure 3 shows the day shift and night shift per person accident rates for the entire squadron between September, 1994, and March, 1998. Per person accident rates were calculated as described in Chapter 3, dividing the number of accidents by the percentage of total

manning utilized on each shift. For this analysis, the night shift is represented by both swing shift and mid shift personnel during 8-hour operations, and strictly night shift personnel during 12-hour operations.

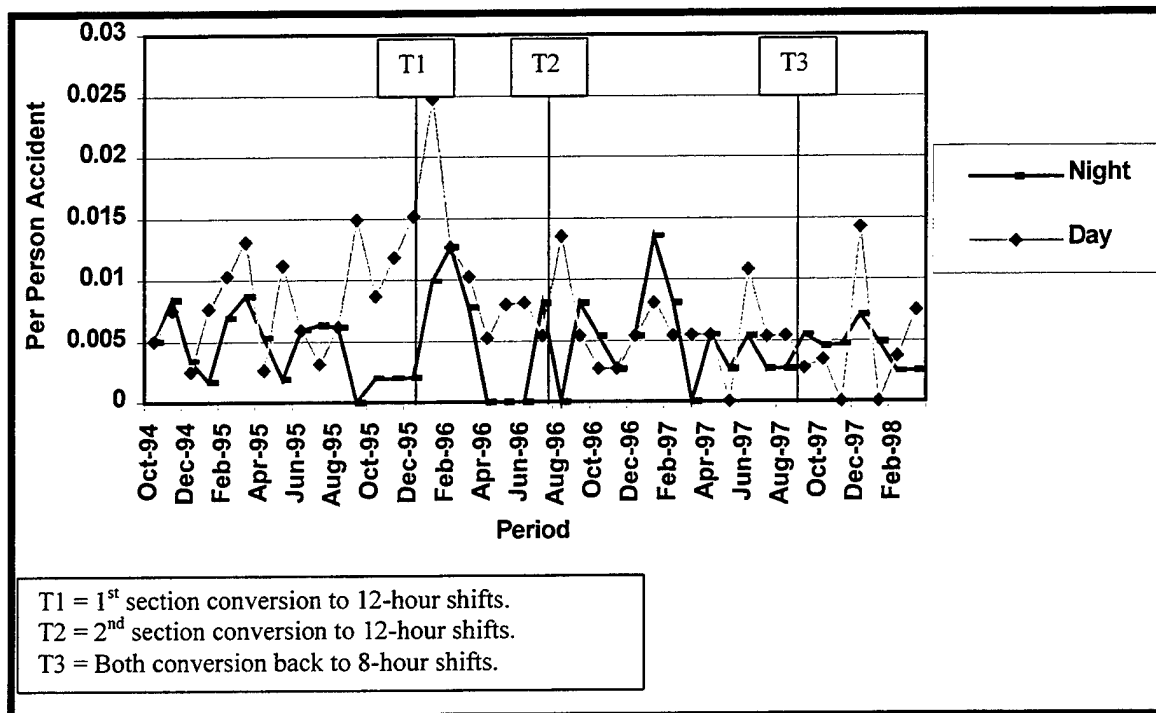


Figure 3. Night Shift vs. Day Shift Accident Rates.

Results of the analysis show no significant difference between a 6-month period well before either section converted to 12-hour shifts (October, 1994 – March, 1995), a 6-month period when both sections were on 12-hour shifts (October, 1996 – March, 1997), and the 6-month period after both sections converted back to 8-hour shifts (October, 1997 – March, 1998). The same months were used, as done previously, to control for seasonality. Note the increase in accident rates immediately following the first sections conversion to 12-hour shifts. It is also interesting that the month after the second section converted to 12-hour shifts the accident rate again climbed. However, immediately

following the conversion to 8-hour shifts, there wasn't an increase in accident rates. A significant difference between night shift and day shift was expected over all time periods. No differences existed for any of the time periods examined. Supervisory involvement and comprehensive safety briefings at each shift change most likely contributed to the low level of accidents experienced by night shift personnel.

Several studies have been conducted to examine the effects of long workdays on workers health and well being. Nearly all of the studies concluded that longer workdays are associated with an increase in health symptoms (Sparks & Cooper, 1997). Budnick et al. (1994) reported that shift workers have an increased risk of adverse health effects. Sparks and Cooper (1997) found that longer hours of work were associated with increased stress and fatigue. Lees and Laundry (1989) reported that increased stress and fatigue were associated with an increase in health-related symptoms. Numerous studies support the notion that longer workdays increase health problems.

An increase in the number of hospital visits was expected during 12-hour shift operations, an indication of the adverse effects of longer workdays on workers health and well being. Figure 4 shows the average per person hospital visits, by month, between October, 1994, and March, 1998.

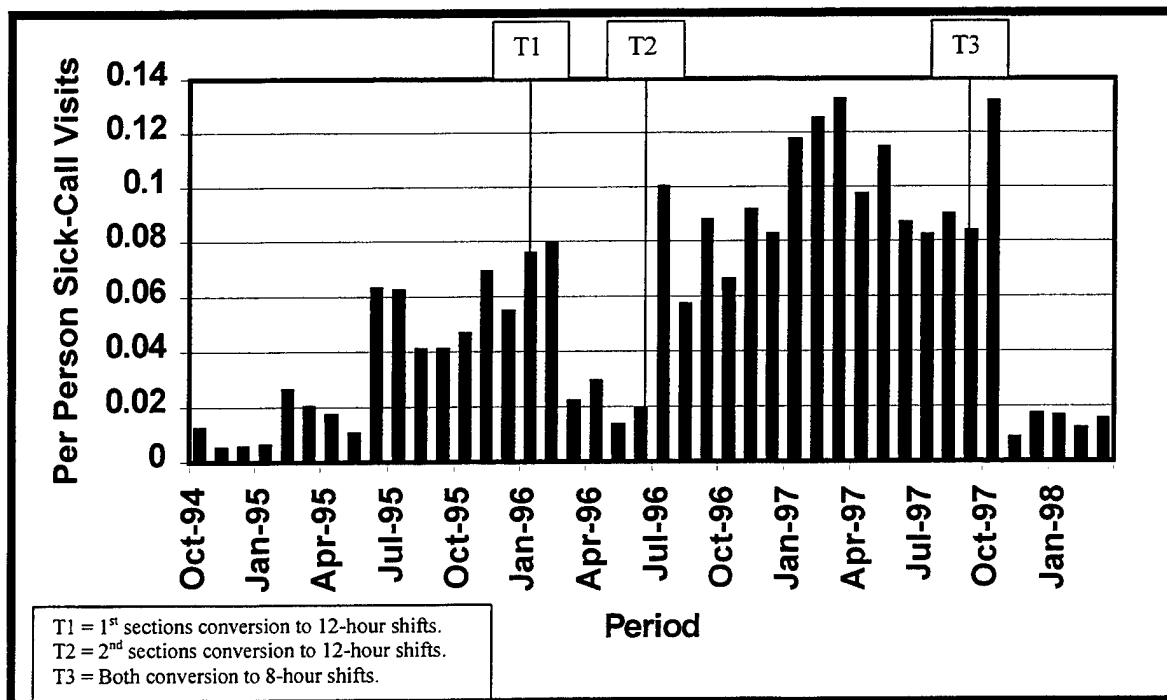


Figure 4. Sick-Call Hospital Visits Per Person.

The number of hospital visits during a 6-month time period when both sections were on 12-hour shifts (October, 1996 - March, 1997) is significantly higher ($T=-9.24$, $p<.01$) than a 6-month period prior to the conversion to 12-hour shifts (October, 1994 - March, 1995), and is also significantly higher ($T=9.77$, $p<.01$) than the 6-month period after both sections converted back to 8-hour shifts (October, 1997 - March, 1998). No significant difference between the two 8-hour shift periods existed. The same months were used to control for possible seasonality, as described in the accident analysis. It is important to note the sharp increase in hospital visits immediately following all shift changes, including the change back to 8-hour shifts. Not only are the per person hospital visits higher during the period when both sections were on 12-hour shifts, there is also an

immediate increase in hospital visits following all changes in the work schedule. It appears that the change itself negatively effects workers health, possibly due to the desynchronosis and increased stress brought about by the change. The significantly higher number of hospital visits during the period when 12-hour shifts were used supports the hypothesis that longer workdays lead to an increase in adverse health effects.

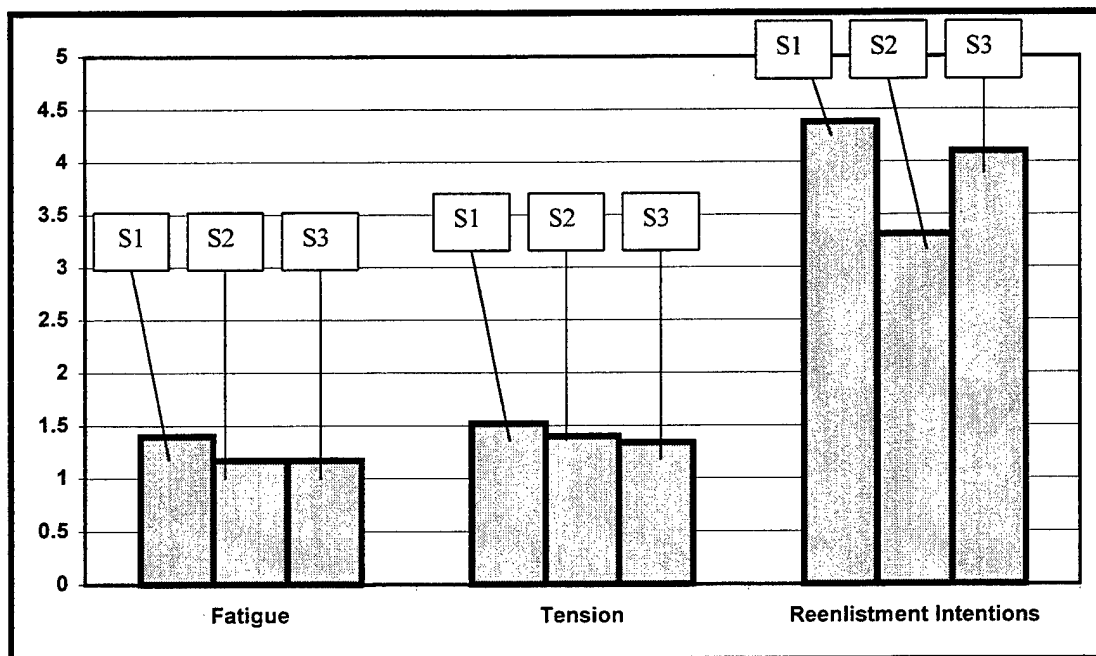


Figure 5. Mean Scores for Fatigue, Tension, and Reenlistment Intentions for Three Surveys.

Lees and Laundry (1989) reported that longer workdays lead to an increase in fatigue. Rosa et al. (1988) also found a strong relationship between extended workdays and increased levels of reported fatigue. Levin et al. (1985) found an increase in stress and fatigue associated with a change in shifts. Figure 5 shows the mean levels of fatigue, tension, and reenlistment intentions for all three surveys. The first survey, S1, was

administered while the majority of the maintenance work force was on 12-hour shifts. The second survey, S2 was administered immediately following the conversion to 8-hour shifts. The third survey, S3 was administered between three and five months following the conversion to 8-hour shifts. Based on the results of previous studies, it is expected that the high levels of fatigue and tension experienced while 12-hour shifts (S1) were in use will rise significantly immediately following the conversion to 8-hour shifts (S2), but will decrease to levels below those on 12-hour shifts after workers have had time to adjust to the 8-hour shifts (S3). Table 1 shows the mean fatigue levels for each of the three surveys.

Table 1. Mean Fatigue Scores for Three Surveys.

Survey	Mean	Standard Deviation	N
S1	1.40	.30	383
S2	1.17	.26	53
S3	1.17	.29	73

Fatigue levels dropped significantly immediately following the conversion to 8-hour shifts ($p < .01$). The level did not drop significantly after 3-5 months on 8-hour shifts. The effect of shift lag did not appear to impact the workers as expected. Instead, the levels of reported fatigue immediately dropped to lower levels after the change to 8-hour shifts and remained at that level over the next 3-5 months. Tension and stress were also

expected to rise significantly following the conversion, again due to the effects of shift lag. The reported levels of tension for all three surveys are shown in Table 2.

Table 2. Mean Tension Scores for Three Surveys.

Survey	Mean	Standard Deviation	N
S1	1.52	.33	380
S2	1.40	.30	53
S3	1.34	.30	72

The reported levels of tension did not increase significantly, as expected, after the conversion to 8-hour shifts. It did, however, decrease significantly ($p < .05$) between the time when 12-hour shifts were in use (S1) and a period 3-5 months following the conversion (S3). The results suggest that tension still existed because of the change of shifts, but eventually decreased to a level significantly lower than that experienced while on 12-hour shifts. Although fatigue decreased significantly immediately following the conversion to 8-hour shifts, tension remained. This is most likely due to the stress brought about by the act of changing. Nevertheless, tension levels did decrease significantly after a period of time.

Reenlistment intentions were expected to rise after 8-hour shifts had been implemented for several months (S3). There were no expectations for the transition period (S2). Table 3 shows the mean reenlistment intentions for all three surveys.

Table 3. Mean Reenlistment Intentions for Three Surveys.

Survey	Mean	Standard Deviation	N
S1	4.38	1.7	382
S2	3.31	1.4	53
S3	4.1	1.6	70

Reenlistment intentions dropped significantly ($p < .05$) immediately following the conversion to 8-hour shifts (S2). They did, however, increase over the next few months. The difference between S1 and S3 is not statistically significant. Laundry and Lees (1989) found that employees embraced the use of extended workdays, particularly compressed workweeks, because of the large blocks of time they have away from the job. This could explain why the reenlistment intentions are higher during the 12-hour period. However, it is important to note the increase after a few months on 8-hour shifts. It is possible that workers on the 12-hour shift schedule made up their minds to leave the Air Force during the eight-month period between S1 and S2 and the decrease in reenlistment intentions for S2 may reflect their decision. A further investigation of reenlistment intentions would be required after a longer adjustment period to determine if the workers were more satisfied with the longer shifts, leading to a higher reenlistment intention (Hellman, 1997), or if the reenlistment intention would eventually rise to a level above that recorded while on extended shifts.

Correlation tables for all three surveys were constructed to examine the effects of shiftwork and change on outcomes such as specific satisfactions, job dissatisfaction, and reenlistment intentions. Table 4 shows the correlations for S1, when the majority of the maintenance workforce was on 12-hour shifts.

Table 4. Correlation Table for Survey 1.

	Reenlist Intention	Fatigue	Growth	Social Sat	Super Sat	Pay	Security	Tension	Mean	Standard Deviation	N
Reenlistment Intention	1.0								4.38	1.69	382
Fatigue	-.18**	1.0							1.34	.30	383
Growth	.41**	-.20**	1.0						4.43	1.34	383
Social Satisfaction	.31**	-.25**	.57**	1.0					4.91	1.04	383
Supervisory Satisfaction	.28**	-.19**	.59**	.55**	1.0				4.60	1.50	383
Pay	.36**	-.1*	.47**	.39**	.41**	1.0			3.13	1.51	383
Security	.39**	-.18**	.54**	.42**	.43**	.50**	1.0		4.27	1.51	383
Tension	-.17**	.56**	-.10*	-.17**	-.19**	-.10*	-.23**	1.0	1.53	.33	380

Note: * Correlation is significant at the .05 level (1-tailed).

** Correlation is significant at the .01 level (1-tailed).

Fatigue and stress were expected to be significantly negatively related to specific satisfactions (growth, pay, security, social, and supervisory) during the time when 12-hour shifts were used. Both fatigue and tension are significantly negatively related to all of the specific satisfactions. Thus, increases in tension and fatigue lead to a decrease in specific satisfactions. Another expectation was that specific satisfactions would be positively related to reenlistment intentions, a predictor of the actual reenlistment (Ajzen & Fishbein, 1980). All of the specific satisfactions are significantly (at the .01 level)

positively related to reenlistment intentions during this time ($r=.41$ growth, $r=.31$ social satisfaction, $r=.28$ supervisory satisfaction, $r=.36$ pay, $r=.39$ security). During the time of change or transition, immediately following the conversion back to 8-hour shifts, no relationships were expected because of the uncertainty of workers attitudes. Table 5 shows the correlations for S2, administered immediately following the conversion to 8-hour shifts.

Table 5. Correlation Table for Survey 2.

	Reenlist Intention	Job Dissat	Shift Dissat	Social Support Family	Social Support Super	Social Support Cowork	Fatigue	Tension	Leader Member Exchange	Mean	Standard Dev	N
Reenlistment Intention	1.0									3.31	1.40	53
Job Dissatisfaction	-.41**	1.0								3.56	.72	51
Shift Dissatisfaction	-.10	.35**	1.0							2.06	1.31	53
Social Support Family	.13	.01	-.17	1.0						3.46	.70	52
Social Support Supervisor	-.03	-.18	-.17	.27*	1.0					2.66	.81	53
Social Support Coworkers	.26*	-.03	-.10	.30*	.41**	1.0				2.72	.66	53
Fatigue	.12	-.03	-.04	.07	-.05	.10	1.0			1.17	.26	53
Tension	-.23*	.20	.04	.06	-.12	-.10	.26*	1.0		1.40	.30	53
Leader/Member Exchange	-.00	-.24*	-.19	.16	.68**	.35**	-.13	.033	1.0	19.66	5.91	53

Note: * Correlation is significant at the .05 level (1-tailed).

** Correlation is significant at the .01 level (1-tailed).

Job dissatisfaction is significantly negatively correlated ($r=-.41$, $p<.01$) with reenlistment intentions. Hellman (1997) reported that a consistent negative relationship between job satisfaction and turnover (job dissatisfaction and reenlistment) existed in his meta-analysis. However, during this time of change fatigue is not significantly correlated with

either job dissatisfaction or reenlistment intentions. Tension, which was expected to rise during the time of change, is significantly negatively related ($r = -.23$, $p < .05$) with reenlistment intentions, but is not significantly related to job dissatisfaction.

Leader/member exchange, a measure of the quality of information exchange between supervisors and subordinates, is significantly negatively related ($r = -.24$, $p < .05$) to job dissatisfaction. This suggests that the greater the quality of exchange between supervisors and subordinates during time of change, the less dissatisfied the subordinates are with the job. No significant relationships existed between social support from family, supervisors, and coworkers and job dissatisfaction. Gordon et al. (1986) suggested that workers would need increased support from family, coworkers, and supervisors to aid in coping with the stress and disruption caused by change. It is important that supervisors and coworkers realize that, during times of change, increased support could ease the stress felt by subordinates and coworkers. Table 6 shows the correlations for S3, administered between 3-5 months after the conversion to 8-hour shifts. Job dissatisfaction is strongly negatively correlated with reenlistment intentions ($r = -.56$, $p < .01$), as expected. Social support from supervisors ($r = -.28$, $p < .01$) and social support from coworkers ($r = -.2$, $p < .05$) are negatively correlated with job dissatisfaction. As social support from supervisors and coworkers increase, job dissatisfaction decreases.

Table 6. Correlation Table for Survey 3.

	Reenlist Intention	Job Dissat	Shift Dissat	Social Support Family	Social Support Super	Social Support Cowork	Fatigue	Tension	Leader Member Exchange	Mean	Standard Dev	N
Reenlistment Intention	1.0									4.09	1.57	70
Job Dissatisfaction	-.56**	1.0								3.21	.78	69
Shift Dissatisfaction	-.25*	.20	1.0							1.71	.98	72
Social Support Family	.15	.07	-.07	1.0						3.40	.68	71
Social Support Supervisor	.29**	-.28**	-.16	.34**	1.0					2.77	.81	72
Social Support Coworkers	.23*	-.20*	-.09	.26*	.39**	1.0				2.84	.66	72
Fatigue	-.41**	.21*	.14	-.26*	-.31**	-.11	1.0			1.17	.29	73
Tension	-.37**	.46**	.25*	-.22*	-.56**	-.20*	.60	1.0		1.34	.30	72
Leader/Member Exchange	.34**	-.31**	-.12	.23*	.65**	.12	-.21*	-.38**	1.0	20.48	4.52	73

Note: * Correlation is significant at the .05 level (1-tailed).

** Correlation is significant at the .01 level (1-tailed).

Leader/member exchange is also significantly positively correlated with reenlistment intentions ($r=.34$, $p<.01$) and negatively correlated with job dissatisfaction ($r=-.31$, $p<.01$). These results reemphasize the importance of meaningful interaction between supervisors and subordinates and also show the positive impact that support from coworkers has on the worker. Although mean fatigue and tension scores were significantly lower after the shift to 8-hour shifts, their relationship to job dissatisfaction and reenlistment intentions is apparent in S3. Fatigue is significantly negatively correlated ($r=-.41$, $p<.01$) with reenlistment intentions and positively related to job dissatisfaction ($r=.21$, $p<.05$). Tension is also negatively related to reenlistment intentions ($r=-.34$, $p<.01$) and positively related to job dissatisfaction ($r=.46$, $p<.01$). The absence of these relationships immediately following the change to 8-hour shifts suggests

that during times of change and transition there is much confusion among the workers. The reappearance of the relationships after a period of 3-5 months could be caused by desynchronosis. Although levels of fatigue dropped immediately following the conversion to 8-hour shifts, the lasting effects of the change are evident from the strong relationships between tension and fatigue, and reenlistment intentions and job dissatisfaction months after the change occurred.

V. Conclusion and Recommendations

Conclusion

This research supported the belief that extended workdays have an adverse impact on worker's health and well being. The drastic increase in sick-call hospital visits while the squadron under study was on 12-hour shifts suggests that much care and preparation should be taken prior to the implementation of extended shifts. The military has reduced manpower significantly over the past several years. This reduction has forced commanders to find ways to meet demanding mission requirements with fewer personnel. Additionally, with the increase in operations tempo and deployments all over the world, working longer hours is sometimes a necessity to ensure mission readiness and maintain complex equipment around-the-clock. It is imperative that leaders understand the effects of longer workdays on the individual so they can better prepare for contingencies and retain experienced personnel.

An in-depth study was performed to investigate the effects of longer workdays on safety. On- and off-duty accident rates were examined at times when 8-hour shifts were in use and compared to periods when 12-hour shifts were used. No significant differences existed between the periods of 8-hour and 12-hour shifts. However, immediately following the change to 12-hour shifts by two different sections at two different times, on-duty accident rates increased for a period of time before returning to lower levels. Day shift and night shift accident rates were also compared during both shift operations. No significant difference existed between any of the periods between day shift and night shift per person accident rates.

This study also provided an examination of individual attitudes and outcomes. Increased levels of fatigue were reported during the use of 12-hour shifts, as were increased levels of tension and stress. The workers attitudes during the transition from 12-hour shifts to 8-hour shifts were very unpredictable, possibly due to the lack of prior experience to compare their situation with. Fatigue and stress were negatively related to reenlistment intentions and specific satisfactions during 12-hour shifts. During the transition to 8-hour shifts there was no significant relationship between fatigue, stress, and reenlistment intentions. After a period of time (3-5 months) on 8-hour shifts, fatigue and stress, though significantly lower than levels reported while on 12-hour shifts, again showed strong significant relationships with reenlistment intentions and job dissatisfaction. The effects of change appear to be long lasting.

Recommendations

The use of extended workdays, though becoming increasingly popular, will probably result in an increase in adverse health effects on the workers. Not only did hospital visits sharply increase after the implementation of 12-hour shifts in the squadron studied, they also increased significantly after the change to 8-hour shifts. Change itself seems to have a negative impact on workers health. These impacts can be long lasting. Commanders considering the use of extended shifts should review the literature prior to their implementation to gain an understanding of the possible outcomes. The first step in preparing for the change should be to educate the workforce on appropriate coping strategies and support the personnel throughout the process (Monk, 1988). Many problems that come with extended workdays can be alleviated with proper education and awareness.

Another recommendation is to let the workers choose their shift whenever possible. This is not always possible in the military because of the necessity to maintain a certain number of supervisors on each shift, or the need to provide guidance and close supervision to individuals in upgrade training. Nevertheless, workers should be given a choice of shifts whenever possible. Barton et al. (1993) reported that when workers can choose their shifts, health problems are likely to be far less compared to individuals who have no control over their work schedule. If a choice is not possible, there are several issues that should be considered prior to putting someone on a shift other than the typical day shift. Some people may not be suited to work a swing shift or a midnight shift. Some people are “rigid sleepers” or “morning larks” who may not be able to adjust to shiftwork, while others are “flexible sleepers” or “night owls” who may adjust easily and be well-suited for shiftwork (Tepas & Monk, 1987).

Another important factor concerning shiftwork is that physically fit individuals (exercise regularly) have higher circadian rhythm amplitudes and are more tolerant to shiftwork (Ferrer et al., 1995:573). Luna (Crew Systems Directorate, 1996) reported that off-duty physical conditioning may decrease fatigue and increase alertness on the night shift. Another recommendation is to encourage workers to exercise during their shift, or to place exercise equipment in or near the worksite (Crew Systems Directorate, 1996). Offering workers time to exercise throughout the shift and encouraging and promoting physical fitness could pay huge dividends when it comes time to deploy or work extended shifts.

Ferrer et al. (1995) discussed preadjustment strategies for deployments, including resetting watches and adjusting schedules to the time zone at the destination before

traveling. Ferrer et al. (1995) further discussed how preadjustment could lead to an adjustment to the new time zone prior to departure or deployment, leading to full physical and mental capabilities upon arrival. This preadjustment could be taken a step further. Changing to the shifts that will be worked, whether 12-hour or shorter, prior to the departure could alleviate some of the health problems that would arise after deployment. These problems could be dealt with at a location where medical care is more readily available, and could help deploying commanders ensure their personnel are healthy and mission-ready. Care should be taken not to convert to extended shifts too far in advance, as fatigue could increase and have a detrimental effect on workers. Further research should be accomplished to determine acceptable adaptation periods and the correct timing of changing to extended shifts ahead of time without overtiring the workers before they actually deploy.

Air Force Reserve and Air National Guard units have been heavily involved in deployments and contingencies in the recent past, and will most likely continue to be a major player in worldwide operations in the future. Therefore, the recommendations made by the author could be particularly helpful for these organizations in their preparation for deployments and understanding of issues surrounding extended workdays.

Another important issue is the effect of change on the worker. Results of this study suggested long lasting effects of change, and the possibility of stress remaining at high levels well after the change has taken place. In the past, based on personal experience and the experience of those who have deployed, commanders and supervisors often implement changes in work schedules at various times during short-term deployments (90 – 120 days). Based on the results of this study, and the literature on

desynchronosis, it is recommended that any change in shifts during deployments should be carefully analyzed and carried out with caution. Individuals adapt at different rates (Folkard & Monk, 1979:489), and the effects of change could be long lasting.

Additional Reading

This study addresses only a few of the many concerns with shiftwork. Scott (1998) performed a similar study that concentrated on shiftwork and performance outcomes. The combination of these studies present an in-depth view of the effects of shiftwork on an aircraft generation squadron that utilized extended shifts for an extended period of time. Several comparisons were made between periods when 8-hour shifts were used and periods when 12-hour shifts were used. In addition to these studies, Luna's (Crew Systems Directorate, 1996) report on shiftwork provides valuable insight on issues surrounding shiftwork and strategies that could make shiftwork more tolerable.

Appendix A: Sample Survey 1

**HQ AMC SPONSORED
WORK PERFORMANCE RESEARCH STUDY**

WORK ENVIRONMENT FACTORS SURVEY II

for

AERIAL PORT PERSONNEL

1. Please write your name, rank, office symbol, and score sheet number in the spaces provided below.
2. Read the INFORMATION ABOUT THIS RESEARCH STUDY and PRIVACY ACT information.
3. Enter your name on the computer score sheet provided with this booklet.
4. Complete the survey using the computer score sheet provided.

The success of this project depends on the accuracy of the information you provide. Please do your best to be honest. Your responses will be kept confidential.

Number: _____ Name: _____ Rank: _____

Office Symbol: _____ Section: _____

Score Sheet Number: _____ Current Shift: _____

FOR OFFICIAL USE ONLY

INFORMATION ABOUT THIS STUDY

Thank you for participating in this research project. Your participation in this survey is strictly VOLUNTARY. Your work experience will make an important contribution to the goals of this research project.

Confidentiality of your responses: This information is being collected for research purposes only. No one in your unit, base, or MAJCOM will EVER be allowed to see your responses. You are welcome to discuss this questionnaire with anyone you choose, but please wait until they have had a chance to participate.

PRIVACY ACT STATEMENT

In accordance with AFR 12-35, paragraph 8, the information below is provided as required by the Privacy Act of 1974.

Authority: 10 U.S.C. 8012, Secretary of the Air Force; powers and duties; delegation by; implemented by AFR 30-23, USAF Survey Program.

Purpose: To evaluate the influence of different types of constraints on the performance of Air Force members.

Routine Use: To increase understanding of factors affecting work performance. No analyses of individual responses will be conducted. Reports summarizing trends in large groups of people may be published.

Participation: Participation is VOLUNTARY. No adverse action will be taken against any member who does not participate in this survey or who does not complete any part of the survey.

BACKGROUND INFORMATION

This information will be used to develop a profile of the participants in this study. Your responses will be kept completely confidential. Please record your answers on the computer sheet provided.

- | | |
|---|--|
| <p>1. What is your sex? (choose one):</p> <ul style="list-style-type: none">(a) Male(b) Female <p>2. What is your race? (choose one):</p> <ul style="list-style-type: none">(a) White(b) Black(c) Hispanic(d) Asian(e) Other <p>3. How old are you? (choose one):</p> <ul style="list-style-type: none">(a) Less than 20 years(b) 20-25 years(c) 26-30 years(d) 31-40 years(e) more than 40 <p>4. Highest education level completed?</p> <ul style="list-style-type: none">(a) Did not complete High School(b) High School Diploma or GED(c) 2-Year College Degree(d) 4-Year College Degree(e) Other | <p>5. How long have you worked for the Air Force?</p> <ul style="list-style-type: none">(a) Less than 2 years(b) 2 to 5 years(c) 6 to 10 years(d) 11 to 15 years(e) more than 15 years <p>6. What is your present grade?</p> <ul style="list-style-type: none">(a) E-1 or E-2(b) E-3 or E-4(c) E-5(d) E-6(e) E-7 or higher <p>7. How long have you worked in the same work center?</p> <ul style="list-style-type: none">(a) Under 2 months(b) 2-3 months(c) 4-5 months(d) 6 months or longer <p>8. What is your skill level? (choose one):</p> <ul style="list-style-type: none">(a) 1 (b) 3 (c) 5 (d) 7 |
|---|--|

Describing Your Job

Listed below are a number of items which may or may not describe your present *job situation* in the Air Force. We are interested in the extent to which each of these statements describes *your particular job situation*. In this section we want to know about your job and not about your attitudes toward that job. Thus, as you complete this questionnaire, think about the job environment you work in, not how you feel about it or what you do in it.

Using the scale below, rate how accurately each statement describes your present job situation in the Air Force. Write the number which represents your rating on the computer score sheet. As you read through the list, you will note that some of the statements are similar. However, no two of them are exactly alike or have exactly the same meaning. You should simply respond to them as they come and not feel any special need to check back to make answers agree. Please be sure to respond to all of the items.

	1	2	3	4	5	
	Not at all Accurate	Somewhat Accurate	Fairly Accurate	Very Accurate	Completely Accurate	
9. The Air Force frequently does not provide me with the necessary tools and/or equipment when needed. _____						18. It often takes me too long to do my job because I have to deal with "red tape." _____
10. I often must work with and depend upon others who are not well trained. _____						19. I often cannot get my job done because policies, procedures, and instructions are changed without enough advance notice. _____
11. I frequently cannot get necessary materials, supplies, and/or parts when I need them. _____						20. I cannot get the transportation I need to do my job when I need it. _____
12. The information I must have in order to do my job is often not available. _____						21. I frequently do not have enough of the right tools and/or equipment to do my job. _____
13. I am frequently given unscheduled activities to work on which keep me from getting my job done. _____						22. The Air Force has not provided me with enough training to do my job. _____
14. I never have enough time to finish my duties without rushing. _____						23. The information I need to do my job is frequently wrong when I receive it. _____
15. The cooperation I am supposed to get from others frequently does not help me get my job done. _____						24. The Air Force does not provide me with the necessary materials, supplies, and/or parts when I need them. _____
16. My job is typically harder to do because I have to make up for a shortage of capable personnel in my unit. _____						25. My work doesn't get done because my schedule often gets changed without enough advance notice. _____
17. I am often hampered in doing my job by bad weather conditions (too hot, etc.). _____						

26. The cooperation I am supposed to receive frequently does not come when I need it.

27. I typically am not given the time I need to do my job.

28. I often find that I have too much work to do in order to make up for a lack of qualified personnel in my unit.

29. My job is frequently made more difficult by bad weather conditions (too hot, too cold, too wet, etc.).

30. My job is often made harder because I am not given enough advance notice about major changes in policies, procedures, and/or instructions.

1	2	3	4	5
Not at all Accurate	Somewhat Accurate	Fairly Accurate	Very Accurate	Completely Accurate

31. I often cannot finish my job on time because of "red tape."

40. Long time delays keep me from getting my job done.

32. The required forms I need to complete to get my job done are often not available.

41. I frequently receive inconsistent policies, procedures, and instructions which make it difficult to do my job.

33. I often have to wait for a long time to get the transportation I need to do my job.

42. Too much "red tape" frequently keeps me from getting my job done on time.

34. I often have to follow the instructions of others even though I am in a better position to know what should be done.

43. I often cannot obtain the forms I need to get my job done.

35. I frequently must work with faulty or damaged tools and/or equipment.

44. Continually having to get the approval of others often keeps me from getting my job done.

36. The lack of qualified people in my unit typically makes it difficult for me to get my job done.

45. The Air Force often provides me with tools and/or equipment which are poorly designed for getting my job done.

37. I am not usually given enough training to handle new duties which are added to my job.

46. It is hard for me to get the help from others that I need to do my job.

38. I frequently get job information from others which is inconsistent.

47. My job is often made harder because I must follow specific policies, procedures, and instructions which I know to be wrong.

39. I am frequently provided with the wrong materials, supplies, and/or parts.

48. I must work with and depend upon others who are poorly trained to do their jobs.

49. I frequently have to wait on others to do their jobs before I can finish my own work.

50. Bad weather conditions (too hot, too cold, too wet, etc.) make doing my job more difficult.

51. There are frequent delays in getting the transportation I need in order to do my job.

52. The tools and/or equipment I must work with are often broken.

53. The cooperation I receive from others is often so poor that it doesn't help me get my job done. _____

54. The information I need to do my job is often incorrect when I receive it.

55. The inconsistent policies, procedures, and instructions I often receive make it difficult for me to get my job done.

56. The proper forms I need to do my job are often not available.

57. I am often not able to do my job well because I am not allowed to make those job decisions I can make best.

58. The equipment I am given is poorly designed for getting my job done.

59. The replacement materials, supplies, and/or parts I receive are often the wrong ones.

60. I often do not have the information I must have at work when it is needed.

61. I often cannot get my work done because I am not told of schedule changes far enough ahead of time.

1	2	3	4	5
Not at all Accurate	Somewhat Accurate	Fairly Accurate	Very Accurate	Completely Accurate

62. I often have to wait too long to get the help I need to do my job. _____
63. The incorrect policies, procedures, and instructions I often receive make it difficult for me to get my job done. _____
64. I frequently have trouble getting cooperation from others who are supposed to help me do my job. _____
65. The information I get from others which I need to do my job is often inconsistent. _____

This section consists of a number of words that describe different feelings that people experience. Your responses to these questions will help us understand your reactions to recent changes in the Air Force. For each word, indicate on your score sheet the extent that you have felt this way during the 8 weeks.

1	2	3	4	5
Very Slightly or Not at All	A Little	Moderately	Quite a Bit	Extremely

- | | | | | | |
|----------------|-------|------------------|-------|----------------|-------|
| 66. Interested | _____ | 73. Hostile | _____ | 80. Nervous | _____ |
| 67. Distressed | _____ | 74. Enthusiastic | _____ | 81. Determined | _____ |
| 68. Excited | _____ | 75. Proud | _____ | 82. Attentive | _____ |
| 69. Upset | _____ | 76. Irritable | _____ | 83. Jittery | _____ |
| 70. Strong | _____ | 77. Alert | _____ | 84. Active | _____ |
| 71. Guilty | _____ | 78. Ashamed | _____ | 85. Afraid | _____ |
| 72. Scared | _____ | 79. Inspired | _____ | | |

Using the scale below, rate how **accurately** each statement describes your present job situation in the **Air Force**. Write the number which represents your rating on the computer score sheet. As you read through the list, you will note that some of the statements are similar. However, no two of them are exactly alike or have exactly the same meaning. You should simply respond to them as they come and not feel any special need to check back to make answers agree. Please be sure to respond to all of the items.

1 Very Little	3 A Moderate Amount	5 Very Much
86. To what extent do you find out how well you are doing on the job as you are working?		89. To what extent do you receive information from your superior on your job performance?
87. How much are you left on your own to do your own work?		90. To what extent are you able to do your job independently of others?
88. To what extent are you able to act independently of your supervisor in performing your job function?		

Please complete the following questions as you did the previous ones.

1 A Minimum Amount	3 A Moderate Amount	5 Very Much
89. The feedback from my supervisor on how well I am doing.		93. The feeling that I know whether I am performing my job well or poorly.
90. The freedom to do pretty much what I want on my job.		94. The control I have over the pace of my work.
91. The opportunity to find out how well I am doing my job.		
92. The opportunity for independent thought and action.		

1	2	3	4	5	6	7
Strongly Disagree	Disagree	Slightly Disagree	Neither agree no Disagree	Slightly Agree	Agree	Strongly Agree

95. My supervisor demands that people give their best effort.

98. My supervisor maintains high standards of performance.

96. My supervisor insists that subordinates work hard.

99. My supervisor is competent.

97. My supervisor demands that subordinates do high quality work.

How satisfied are you with the following aspects of your job? Please answer the following questions using the following scale.

1	2	3	4	5	6	7
Extremely Dissatisfied	Dissatisfied	Slightly Dissatisfied	Neutral	Slightly Satisfied	Satisfied	Extremely Satisfied

100. The amount of job security I have.

107. The amount of support and guidance I receive from my supervisor.

101. The amount of pay and fringe benefits I receive.

108. The degree to which I am fairly paid for what I contribute to this organization.

102. The amount of personal growth and development I get in doing my job.

109. The amount of independent thought and action I can exercise in my job.

103. The people I talk to and work with on my job.

110. How secure things look for me in the future in this organization.

104. The degree of respect and fair treatment I receive from my boss.

111. The chance to help other people while at work.

105. The feeling of worthwhile accomplishment I get from doing my job.

112. The amount of challenge in my job.

106. The chance to get to know other people while on the job.

113. The overall quality of supervision I receive in my work.

Please answer the following questions True or False.

1 = False

2 = True

114. My job tends to directly affect my health.

115. I would consider myself in good or excellent health.

116. I work under a great deal of tension.

117. I have felt fidgety or nervous as a result of my job.

118. I would consider myself in fair health.

119. If I had a different job, my health would probably improve.

120. I do not have very good health.

121. I wake up with stiffness or aching in joints or muscles.

122. Problems associated with my job have kept me awake at night.

123. I seem to tire quickly.

124. I have felt nervous before attending meetings in the company.

125. I often "take my job home with me" in the sense that I think about it when doing other things.

Again, use the following scale to answer the next series of questions.

1	2	3	4	5	6	7
Never	One Time	Few Times	Several Times	Many Times	Great Number of Times	Constantly

In the last few years (1994 to the present) how many times has a supervisor or commander...

- 126. sent you a letter of appreciation?
- 127. recommended you for an award (even if you didn't get the award)?
- 128. offered you a more important job?
- 129. put you in charge of a project?
- 130. recommended you for a Professional Military Education (PME) program *(even if you didn't actually attend it)?*
- 131. recommended you for some other type of *training (even if you did not actually attend it)?*
- 132. nominated you for an Airman or NCO of the Quarter Award (or a monthly or yearly award)?
- 133. recognized your good work at a Commander's Call or another group meeting?
- 134. recommended you for a special duty assignment *(even if you didn't get it)?*
- 135. tried to help you get an assignment that would help your career *(even if you didn't get it)*
- 136. nominated you for early promotion to the next rank *(even if you didn't get it)?*
- 137. recommended you for a medal or ribbon *(even if you didn't get it)?*

Please use this scale for the questions below.

1	2	3	4	5
Much Below Average	Below Average	Average	Above Average	Much Above Average

Compared with the performance of other people at work, how effective are you in...

- 138. getting along with others at work
- 139. applying technical knowledge to real-world problems
- 140. staying motivated
- 141. helping others get tasks done
- 142. respecting others
- 143. maintaining your physical fitness
- 144. encouraging others to do better

- 145. using common sense to solve a problem
- 146. overcoming obstacles to get the job done
- 147. getting others to cooperate
- 148. seeing a task through to completion
- 149. performing technical tasks skillfully
- 150. maintaining good working relationships
- 151. taking the initiative to make improvements in work processes
- 152. helping a coworker with his tasks
- 153. treating others fairly

Please use the following scale for the remaining questions.

1	2	3	4	5	6	7
Strongly Disagree	Disagree	Slightly Disagree	Neither agree no Disagree	Slightly Agree	Agree	Strongly Agree

- | | |
|---|---|
| 154. I rarely make errors at work. | 168. After my shift is over, I have enough energy to participate in my favorite activities. |
| 155. My section has experienced a high number of accidents. | 169. I enjoy working my current schedule. |
| 156. I am frequently tired at the end of my shift. | 170. My coworkers frequently make errors in work. |
| 157. I wish I could work the opposite shift. | |
| 158. I enjoy being in the Air Force and Plan to reenlist. | |
| 159. They expect too much work from my section. | |
| 160. I have time to exercise. | |
| 161. Changes are made with little regard for the welfare of squadron members. | |
| 162. I plan on continuing m career choice. | |
| 163. I often feel worn out and tired on the job. | |
| 164. I spend too much time at work. | |
| 165. I would like to work in a different section. | |
| 166. I have time to conduct my personal business. | |
| 167. I do no spend enough time with my family. | |

Appendix B: Sample Survey 2 and 3

**Work Shifts, Environment, and Organizational Effectiveness
Questionnaire**

1. Please write your name, rank, office symbol, and score sheet number in the spaces below.
2. Read the INFORMATION ABOUT THIS RESEARCH STUDY and PRIVACY ACT information.
3. Enter your name on the computer score sheet provided with this booklet.
4. Complete the survey using the computer score sheet provided.

**The success of this project depends on the accuracy of the information you provide.
Please be honest. Your responses will be kept confidential.**

Score Sheet Number: _____ Name: _____ Rank: _____

Office Symbol: _____ Section (Red, Blue, N/A) _____

Current Shift (8 or 12 hour) _____

INFORMATION ABOUT THIS STUDY

Thank you for participating in this research project. Your participation in this survey is strictly **VOLUNTARY**. Your work experience will make an important contribution to the goals of this research project.

Confidentiality of your responses: This information is being collected for research purposes only. **No one** in your unit, base, or MAJCOM will see your responses. You are welcome to discuss this questionnaire with anyone you choose, but please wait until everyone has had a chance to participate.

PRIVACY ACT STATEMENT

In accordance with AFR 12-35, paragraph 8, the information below is provided as required by the Privacy Act of 1974.

Authority: 10 U.S.C. 8012, Secretary of the Air Force; powers and duties; delegation by; implemented by AFR 30-23, USAF Survey Program.

Purpose: To evaluate the influence of shift schedules and different types of constraints on the performances of Air Force members.

Routine Use: To increase understanding of factors affecting work performance. No analyses of individual responses will be conducted. Reports summarizing trends in large groups of people may be published.

Participation: Participation is **VOLUNTARY**. No adverse action will be taken against any member who does not participate in this survey or does not complete any part of this survey.

BACKGROUND INFORMATION

The information gathered will be used to develop the profile of the participants in the study. Your responses will be kept completely confidential. Please record your answers on the computer sheet provided.

1. What is your sex?

- (1) Male
- (2) Female

2. What is your race?

- (1) White
- (2) Black
- (3) Hispanic
- (4) Asian
- (5) Other

3. What is your age?

- (1) Less than 20 years
- (2) 20-25 years
- (3) 26-30 years
- (4) 31-40 years
- (5) Over 40 years

4. Highest education level completed?

- (1) Did not complete high school
- (2) High school diploma or GED
- (3) 2-year college degree
- (4) 4-year college degree
- (5) Other

5. How long have you worked for the Air Force?

- (1) Less than 2 years
- (2) 2 to 5 years
- (3) 6 to 10 years
- (4) 11 to 15 years
- (5) More than 15 years

6. What is your present grade?

- (1) E-1 or E-2
- (2) E-3 or E-4
- (3) E-5
- (4) E-6
- (5) E-7 or higher

7. How long have you worked in the same work center?

- (1) Less than 2 months
- (2) 2-6 months
- (3) 6 months-1 year
- (4) More than 1 year

8. What is your current skill level?

- (1) 1
- (2) 3
- (3) 5
- (4) 7

Performance Obstacles and Constraints

Instructions: The next items represent obstacles and constraints that people may encounter in their work which inhibit good performance. Write the number beside each constraint to indicate how frequently it poses a problem for you.

<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>
Never	Rarely	Sometimes	Often	Always

9. **Job Induced Constraints**

Definition: Factors in the make-up of the job itself (e.g., reliance on other sections) that determine levels of your performance.

10. **Interpersonal or Social Obstacles**

Definition: Represents the quality of interpersonal relationships (e.g., communication climate, cooperation) among individuals who interact with you in the course of your work.

11. **Environmental Obstacles**

Definition: Factors in the physical job environment (e.g., excessive noise or heat) and in the geographical locale of the work that affect your job performance.

12. **Administrative or Policy Constraints**

Definition: Rules, regulations, and requirements imposed upon an individual by your organization or the Air Force that impede your job performance to a greater extent than other workers doing comparable work in a different organization.

Use the following scale to answer the questions below.

<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>
Very Little	A Little	Some	A Lot	A Great Deal
<hr/>				

13. How much do you take part with others making decisions that affect you?

14. How much do you participate with others in helping set the way things are done?

15. How much do you decide with others what part of a task you will do?

Use the following scale to answer the questions below.

<u>1</u>	<u>3</u>	<u>5</u>
Very Little	A Moderate Amount	Very Much
<hr/>		

16. How much are you left on your own to do your own work?

17. To what extent are you able to act independently of your supervisor in performing your job function?

18. To what extent are you able to do your job independently of others?

Use the following scale to answer the questions below.

1	3	5
Very Little	A Moderate Amount	Very Much
<div style="border-top: 1px solid black; height: 10px; width: 100%; position: relative;"> </div>		

19. The freedom to do pretty much what I want on my job.
 20. The opportunity for independent thought and action.
 21. The control I have over the pace of my work.

Please use the scale below to answer the following questions.

1	2	3	4	5	6	7
Strongly Disagree	Disagree	Slightly Disagree	Neither Agree nor Disagree	Slightly Agree	Agree	Strongly Agree
<div style="border-top: 1px solid black; height: 10px; width: 100%; position: relative;"> </div>						

22. I am given enough time to do what is expected of me on my job.
 23. It often seems like I have too much work for one person to do.
 24. The performance standards on my job are too high.
 25. The major satisfaction in my life comes from my job.
 26. I do what my job description requires; my unit does not have the right to expect more.
 27. I don't mind spending a half-hour past quitting time if I can finish a task.
 28. The most important things that happen to me involve my work.
 29. I love my job.
 30. Most things in life are more important than my work.
 31. My job allows me to control my own work pace.
 32. I get to do a number of different things on my job.
 33. I determine the speed at which I work.
 34. My job requires that I do the same things over and over.

Use the following scale to answer the questions below.

1	2	3	4	5
Rarely	Occasionally	Sometimes	Fairly Often	Very Often
<div style="border-top: 1px solid black; height: 10px; width: 100%; position: relative;"> </div>				

35. How often does your job require you to work very fast?
 36. How often does your job require you to work very hard?
 37. How often does your job leave you little time to get things done?
 38. How often is there a great deal to get done?

Use the following scale to answer the questions below.

1	2	3	4	5
Hardly Any	A Little	Some	A Lot	A Great Deal

39. How much slowdown in the workload do you experience?
40. How much time do you have to think and contemplate?
41. How much workload do you have?
42. What quantity of work do others expect you to do?
43. How many projects, assignments, or tasks do you have?
44. How many lulls between heavy workload periods do you have?
-

Please use the following scale to answer the questions below.

7	6	5	4	3	2	1
Very False						Very True

45. I feel certain about how much authority I have.
46. Clear, planned goals and objectives exist for my job.
47. I know that I have divided my time properly.
48. I know what my responsibilities are.
49. I know exactly what is expected of me.
50. Explanation is clear of what has to be done.
-

Please use the following scale to answer the questions below.

1	2	3	4	5	6	7
Very False						Very True

51. I have to do things that should be done differently.
52. I receive an assignment without the manpower to complete it.
53. I have to buck a rule or policy in order to carry out an assignment.
54. I work with two or more groups who operate quite differently.
55. I receive incompatible requests from two or more people.
56. I do things that are apt to be accepted by one person and not accepted by others.
57. I work on unnecessary things.
-
-

Please use the following scale to indicate how often you experience each of the following changes on your job.

1	2	3	4
Hardly or Never	A Little of the Time	Some of the Time	Very Often
----- ----- -----			

58. A marked increase in your workload.
 59. A marked increase in the amount of concentration required on your job.
 60. A marked increase in how fast you have to think.
-

Please use the scale below to answer the following questions.

1	2	3
Never	Once or Twice	Three or More Times

Have you experienced any of the following during the past month on the job?

61. Your hands trembling enough to bother you.
 62. Bothered by shortness of breath when you were not working hard or exercising.
 63. Bothered by your heart beating rapidly.
 64. Hands sweating making you feel damp and clammy.
 65. Spells of dizziness.
 66. You were in ill health which affected your work.

In addition, have you experienced the following? Use the above scale to answer.

67. Loss of appetite.
 68. Trouble sleeping.

69. Do you usually know where you stand...do you usually know how satisfied your immediate supervisor is with what you do?

- (1) Always know where I stand
- (2) Usually know where I stand
- (3) Seldom know where I stand
- (4) Never know where I stand

70. How well do you feel that your immediate supervisor understands your problems and needs?

- (1) Completely
- (2) Well enough
- (3) Some but not enough
- (4) Not at all

71. How well do you feel that your immediate supervisor recognizes your potential?
- (1) Fully
 - (2) As much as the next person
 - (3) Some but not enough
 - (4) Not at all
72. Regardless of how much formal authority your immediate supervisor has built into his or her position, what are the chances that he or she would be personally inclined to use power to help you solve problems in your work?
- (1) Certainly would
 - (2) Probably would
 - (3) Might or might not
 - (4) No chance
73. Again, regardless of the amount of formal authority your immediate supervisor has, to what extent can you count on him or her to "bail you out" at his or her expense when you really need it?
- (1) Certainly would
 - (2) Probably would
 - (3) Might or might not
 - (4) No chance
74. I have enough confidence in my immediate supervisor that I would defend and justify his or her decisions if he or she were not present to do so.
- (1) Certainly would
 - (2) Probably would
 - (3) Maybe
 - (4) Probably not
75. How would you characterize your working relationship with your immediate supervisor?
- (1) Extremely effective
 - (2) Better than average
 - (3) About average
 - (4) Less than average
-

*Please answer the following questions **TRUE** or **FALSE***

1 = FALSE

2 = TRUE

76. My job tends to directly affect my health.
77. I would consider myself in good or excellent health.
78. I work under a great deal of tension.
79. I have felt fidgety or nervous as a result of my job.
80. I would consider myself in fair health.
81. If I had a different job, my health would probably improve.
82. I do not have very good health.
83. I wake up with stiffness or aching in joints or muscles.
84. Problems associated with my job have kept me awake at night.
85. I seem to tire quickly.
86. I have felt nervous before attending meetings in my unit.
87. I often "take my job home with me" in the sense that I think about it when doing other things.

This section consists of a number of words that describe different feelings that people experience. Your responses to these questions will help us understand your reactions to recent changes in the Air Force. **For each word, indicate on your score sheet the extent that you have felt this way during the past month.**

1	2	3	4	5
Very Slightly or Not at All	A Little	Moderately	Quite A Bit	Extremely

- | | | |
|---|--|---|
| 88. Interested
89. Distress
90. Excited
91. Upset
92. Strong
93. Guilty
94. Scared | 95. Hostile
96. Enthusiastic
97. Proud
98. Irritable
99. Alert
100. Ashamed
101. Inspired | 102. Nervous
103. Determined
104. Attentive
105. Jittery
106. Active
107. Afraid |
|---|--|---|

Use the following scale to answer the questions below.

1	2	3	4	5
Rarely	Occasionally	Sometimes	Fairly Often	Very Often

- 108.** I dislike the amount of work I do.
109. I am dissatisfied with the pace of my work.
110. I am unhappy about the pace of my current workload.
111. I dislike the shift I work.
112. I am dissatisfied with my current work schedule.
113. I am unhappy about the my current shift and work schedule.

114. Knowing what you know now, if you had to decide all over again whether to take the type of job you

now have, what would you decide?

- (1) Decide without hesitation to take the same type of job.
- (2) Have some second thoughts.
- (3) Decide definitely not to take this type of job.

115. If you were free to go into any type of job you wanted, what would you choose?

- (1) Take the same type of job I have now.
 - (2) Take a different type of job.
 - (3) Not want to work.
-

116. If a friend of yours told you he was interested in working in a job like yours, what would you tell them?

- (1) Strongly recommend it.
- (2) Have doubts about recommending it.
- (3) Advise them against it.

117. All in all, how satisfied are you with your job?

- (1) Very satisfied
- (2) Somewhat satisfied
- (3) Not too satisfied
- (4) Not at all satisfied

Please use the following scale to answer the questions below.

4	3	2	1	0
Very Much	Somewhat	A Little	Not at All	Don't Have Such A Person

How much does each of these people go out of their way to do things to make your work life easier for you?

118. Your immediate supervisor (boss).

119. Other people at work.

120. Your spouse, friends, and relatives.

How easy is it to talk with each of the following people?

121. Your immediate supervisor (boss).

122. Other people at work.

123. Your spouse, friends, and relatives.

How much can these people be relied on when things get tough at work?

124. Your immediate supervisor (boss).

125. Other people at work.

126. Your spouse, friends, and relatives.

How much is each of the following people willing to listen to your personal problems?

127. Your immediate supervisor (boss).

128. Other people at work.

129. Your spouse, friends, and relatives.

Please use the scale below to answer the following questions.

1	2	3	4	5	6	7
Strongly Disagree	Disagree	Slightly Disagree	Neither Agree Nor Disagree	Slightly Agree	Agree	Strongly Agree

130. I plan on continuing my career choice.
 131. I often think about separating from the Air Force.
 132. I will probably look for a different job within the next year.
 133. I enjoy being in the Air Force and plan to reenlist.
 134. I would reenlist today if I could.

135. In the last few months, what was your typical work schedule?

- (1) I worked a 12 hour day shift
- (2) I worked a 12 hour night shift
- (3) I rotated between day and night shift
- (4) I worked an 8 hour day shift
- (5) I worked an 8 hour shift, but it was not day shift

136. How long did you work the schedule indicated above?

- (1) One month or less
- (2) 2-3 months
- (3) 4-5 months
- (4) 6-7 months
- (5) Eight months or more

137. How much sleep did you get in an average day during this period?

- (1) Less than 3 hours
- (2) 3-4 hours
- (3) 5-6 hours
- (4) 7-8 hours
- (5) Nine hours or more

138. How much sleep do you need to avoid feeling tired at work?

- (1) Less than 3 hours
- (2) 3-4 hours
- (3) 5-6 hours
- (4) 7-8 hours
- (5) Nine hours or more

139. On the average, what was the longest period you were able to sleep without interruption?

- (1) Less than 3 hours
- (2) 3-4 hours
- (3) 5-6 hours
- (4) 7-8 hours
- (5) Nine hours or more

140. If you could sleep as long as you wanted, how much sleep would you want daily?

- (1) Less than 3 hours
- (2) 3-4 hours
- (3) 5-6 hours
- (4) 7-8 hours
- (5) Nine hours or more

141. How much sleep do you need to do your best at work?

- (1) Less than 3 hours
- (2) 3-4 hours
- (3) 5-6 hours
- (4) 7-8 hours
- (5) Nine hours or more

Thank you for taking the time to complete this survey and assist in this research study. Again, be assured that your responses will be held in strict confidentiality and are for research purposes.

Bibliography

- Ajzen, I. and M. Fishbein. Understanding Attitudes and Predicting Social Behavior. New Jersey: Prentice-Hall, 1980.
- Alluisi, E. and B. Morgan. "Temporal Factors in Human Performance and Productivity," in Human Performance and Productivity: Stress and Performance Effectiveness. Eds. E. Fleishman and E. Alluisi. New Jersey: Lawrence Erlbaum Associates, 1982.
- Barton, J. and others. "Does Individual Choice Determine Shiftwork Acceptability?" Ergonomics, 36: 93-100 (January 1993).
- Budnick, L. and others. "Sleep and Alertness in a 12-Hour Rotating Shift Work Environment," Journal of Occupational Medicine, 3: 1295-1300 (December 1994).
- Cammann, C. and others. "Intent to Turnover," in The Experience of Work: A Compendium and Review of 249 Measures and Their Use. London: Academic Press, 1981.
- Caplan, R. "Social Support from Supervisors, Social Support from Others at Work, Social Support from Wife, Friends, and Relatives," in Job Demands and Worker Health. Ann Arbor MI: Survey Research Center, Institute for Social Research, University of Michigan, 1980.
- Crew Systems Directorate. Shiftwork: Basic Concern for Commanders, Supervisors, and Flight Surgeons. (AL/CF-TR-1996-0073). Brooks AFB TX: Armstrong Lab: Author. (AD A318 720), 1996.
- Cunningham, J. "A Compressed Shift Schedule: Dealing With Some of the Problems of Shiftwork," Journal of Organizational Behavior, 10: 231-245 (July 1989).
- Czeizler, C. and others. "Exposure to Bright Light and Darkness to Treat Physiologic Maladaptation to Night Work," The New England Journal of Medicine, 322: 1253-1259 (May 1990).
- Duchon, J. and T. Smith. "Extended workdays and safety," International Journal of Industrial Ergonomics, 11: 37-49 (January 1993).
- Ferrer, C. "Circadian Rhythm Desynchronization in Military Deployments: A Review of Current Strategies," Aviation, Space, and Environmental Medicine, 66: 571-578 (June 1995).

- Fishbein, M. and I. Ajzen. Belief, Attitude, Intention, and Behavior: An Introduction to Theory and Research. Reading MA: Addison-Wesley, 1975.
- Folkard, S. and T. Monk. "Shiftwork and Performance," Human Factors, 21: 483-492 (August 1979).
- Gordon, N. and others. "The Prevalence and Health Impact of Shiftwork," American Journal of Public Health, 76: 1225-1228 (October 1986).
- Hackman, J. R. and G. R. Oldham "Specific Satisfaction," in The Experience of Work: A Compendium and Review of 249 Measures and Their Use. London: Academic Press, 1981.
- Hellman, C. "Job Satisfaction and Intent to Leave," Journal of Social Psychology, 137: 677-680 (December 1997).
- House, R. J. and J. R. Rizzo. "Anxiety-Stress Questionnaire," in The Experience of Work: A Compendium and Review of 249 Measures and Their Use. London: Academic Press, 1981.
- Kelly, R. and M. Schneider. "The Twelve-Hour Shift Revisited: Recent Trends in the Electric Industry," Journal of Human Ergology, 11: 369-384 (1982).
- Kossek, E. and C. Ozeki. "Work-Family Conflict, Policies, and the Job-Life Satisfaction Relationship: A Review and Directions for Organizational Behavior-Human Resources Research," Journal of Applied Psychology, 83: 139-149 (April 1998).
- Klein, M. "Technical Comparison of 8 vs. 12 Hour Shift Schedules: A Case Study," Proceedings of the Human Factors Society 32nd Annual Meeting. Santa Monica CA: Human Factors Society, 1988.
- Laundry, B. and R. Lees. "Comparison of the Effects of an 8-Hour and a 12-Hour Shift System on Worker Injury," in Proceedings of the 20th Annual Conference of the Human Factors Association of Canada. Ontario: Human Factors Association of Canada, 1987.
- Lees, R. and B. Laundry. "Comparison of Reported Workplace Morbidity in 8-Hour and 12-Hour Shifts in One Plant," Journal of the Society of Occupational Medicine, 39: 81-84 (1989).
- Levin, L. and others. "Injury Incidence Rates in a Paint Company on Rotating Production Shifts," Accident Analysis and Prevention, 17: 67-73 (December 1985).

- Monk, T. "Human Factors Implications of Shiftwork," International Review of Ergonomics, 2: 111-128 (1988).
- Northrup, H.R. and others. "The Twelve-Hour Shift in the Petroleum and Chemical Industries Revisited," Industrial and Labor Relations Review, 32: 312-326 (July 1989).
- Overland, D. Comparison of Effects of Change From 8 to 12 Hour Shifts on Air Force Maintenance Workers. MS thesis, AFIT/GTM/LAL/97S-8. Graduate School of Logistics and Acquisition Management, Air Force Institute of Technology (AU), Wright-Patterson Air Force Base OH, September 1997 (AD-A329844).
- Palmer, B. and others. Scientific Review of Air Mobility Command Crew Rest Policy and Fatigue Issues: Volume I: Final Report. (CSERIAC-RA-96-007A-VOL 1). Wright-Patterson Air Force Base OH: Crew System Ergonomics Information Analysis Center (AD B218 332), 1996.
- Quinn, R. P. and G. L. Staines. "Facet-Free Job Satisfaction," in The Experience of Work: A Compendium and Review of 249 Measures and Their Use. London: Academic Press, 1981.
- Rosa, R. and others. "Extended Workdays: Effects of 8-Hour and 12-Hour Rotating Shift Schedules on Performance, Subjective Alertness, Sleep Patterns, and Psychosocial Variables," Work & Stress, 3: 21-32 (1988).
- Scandura, T. and G. B. Grean. "Moderating Effects of Initial Leader-Member Exchange Status on the Effects of a Leadership Intervention," Journal of Applied Psychology, 69: 428-436 (1984).
- Scott, K. A Comparison of 8-Hour vs. 12-Hour Shifts on Performance, Health and Safety in a USAF Aircraft Maintenance Squadron. MS thesis, AFIT/GLM/LAL/98S-11. Graduate School of Logistics and Acquisition Management, Air Force Institute of Technology (AU), Wright-Patterson Air Force Base OH, September 1998.
- Sparks, K. and others. "The Effects of Hours of Work on Health: A Meta-Analytic Review," Journal of Occupational and Organizational Psychology, 70: 391-408 (December 1997).
- Taylor, E. and others. "Models of Shiftwork and Health: An Examination of the Influence of Stress on Shiftwork Theory," Human Factors, 39: 67-82 (March 1997).

Tepas, D. and T. Monk. "Work Schedules," in Handbook of Human Factors. Ed. G. Salvendy. New York: John Wiley and Sons, 1987.

Wagner, R. and J. Sherwood. The Study of Attitude Change. Belmont CA: Brooks/Cole Publishing Company, 1969.

Williamson, A. M. and others. "Changing the Hours of Shiftwork: A Comparison of 8- and 12-hour Shift Rosters in a Group of Computer Operators," Ergonomics, 37: 287-298 (February 1994).

Vita

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13. ABSTRACT (<i>Maximum 200 Words</i>) This study examined the effects of converting a large aircraft maintenance squadron from 8-hour shifts to 12-hour shifts. The squadron studied converted its 24-hour maintenance work force from three 8-hour work shifts to two 12-hour work shifts incrementally, with one section converting to 12-hour shifts in January, 1996, and the remaining section converting in July, 1996. Both sections remained on 12-hour shifts until September, 1997, when both sections converted back to a three shift 8-hour operation. Health and well being, on- and off-duty accident rates, day shift vs. night shift accident rates, and the effects of stress and fatigue on specific satisfactions, job dissatisfaction, and reenlistment intentions were examined. Results showed an increase in hospital visits when 12-hour shifts were employed, as well as an increase in hospital visits immediately following all schedule changes. There were no significant differences in 8-hour and 12-hour shifts on- and off-duty accident rates or day and night shift accident rates. Reported levels of fatigue were significantly greater when 12-hour shifts were used. Tension was greater while on 12-hour shifts, but did not decrease significantly until a few months after the conversion back to 8-hour shifts.				
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